A Modernizing Midwife

Improving Outcomes While Preserving Tradition

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Introduction

In light of increasing globalization and medicalization, public health authorities, physicians and anthropologists have taken an increased interest in the practices of traditional midwives and birth attendants. In many regions, particularly areas marked by significant poverty, midwives attend the majority of births and often serve as primary care providers to women and children. In many cases, midwives represent the only long-term relationship that a community has with a medical professional. Guatemala provides a cogent example of this phenomenon, with nearly 70% of births attended by midwives compared to biomedical providers (Ministerio de Salud Pública y Asistencia Social (MSPAS) et al., 2009). As Guatemala only has hospital capacity to accommodate 20% of annual births, use of midwives is a public health necessity (Bailey, Szászdi, & Glover, 2002). The practices of these midwives, which are often spiritual in nature, have profound traditional significance and are deeply embedded in the culture of many communities.

However, efforts to educate and train Guatemalan midwives in modern obstetric practices began more than a century ago. Made by both national health programs and individual non-profit organizations, interventions included the provision of supplies such as sanitizing agents, gauze and forceps, as well as the administration of training courses of various kinds. Yet it has been found that increased public health interventions have produced minimal effects on the actual practices of rural midwives (Byrne & Morgan, 2011; Goldman & Glei, 2003; Greenberg, 1982; Sibley, Sipe, & Koblinsky, 2004). One study of Guatemalan birth attendants even found that

training led to a decrease in detection of complications (Bailey et al., 2002). Studies attribute these poor outcomes to a number of factors, from poor execution of midwife training programs to financial struggles of the mothers themselves. With such confused results, there are extensive questions concerning the most effective way to encourage midwives to incorporate the benefit of modern and life-saving practices into their traditional routines. Specifically, the first portion of the study will investigate if the characteristics of a midwife's education—such as formal education, taking a midwifery course, or years of experience— have a significant effect on producing favorable practice outcomes. In the second portion of the study, I will investigate whether the type of delivery attendant (traditional versus biomedical) is a significant predictor of maternal practices. Through the current study, I seek to both contribute to the resolution of these questions and gain a greater understanding of ways to improve the practice outcomes of rural Guatemalan midwives.

My emphasis on Guatemala serves several purposes. First, Guatemala is an ethnically and culturally diverse nation that has maintained many traditional practices, particularly in rural regions. As a result, there are a sufficient number of traditional providers to comprise a sample. This has led to a great deal of research on medicalization throughout the region, providing a good base from which to extend current knowledge. Guatemala is also one of the most impoverished nations in the western hemisphere, with high maternal and fetal mortality of 88 deaths/100,000 births and 22.7 deaths/1,000 births, respectively. This contrasts starkly to those measures in the United States, which are 14 maternal deaths/100,000 births and 5.9 fetal deaths/1,000 births. (Central Intelligence Agency, 2011). Similarly, the Guatemalan state has traditionally been very weak and corrupt, exacerbating decreased modernization of healthcare infrastructure compared to many other nations in the region (Hawkins, McDonald, & Adams,

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2013; "World Report 2012: Guatemala | Human Rights Watch," n.d.). In compilation, these factors have shaped Guatemala into an excellent case study for the global phenomenon of medicalization, which impacts maternal and fetal health along with nearly every other area of medicine. Studies that monitor medicalization in this way are extremely important, as its effects on communities can be both positive and negative. In some cases, careless policies and implementation may result in decreased attention to the populations most in need, as well as a decreased emphasis on the traditional methods that may serve to embed culture and unite societies. On the contrary, well-executed policies can eradicate disease and improve the quality of life for millions of individuals.

Traditional midwives comprise an integral part of the structure of many rural Guatemalan communities, and serve numerous roles beyond childbirth. Appreciation of the extent of these roles is critical both to understand the impact that medicalization of midwives can have in a community and to inform health policymakers. The following paragraphs will discuss both the role of the traditional midwife, as well as the changes that medicalization has enacted.

Prevalence and Roles of Midwives.

Around the world, more than 45 million women deliver their children without professional care each year. Approximately two-thirds of these women will be assisted by a traditional birth attendant such as a midwife (The United Nations Children's Fund, 2008). In Guatemala, only 29% of births are attended by a physician (Pan American Health Organization, 1994). This limited access to skilled birth attendance is limited by geographic, financial and transport barriers; shortage of health workers; poor quality of care and communication; and unwillingness of women to leave the home (Byrne & Morgan, 2011).

In birth, a midwife's responsibilities can include prenatal care, attendance and assistance in delivery, and providing emotional and spiritual support for the mother. Beyond assisting with childbirth in these ways, midwives often perform many other roles within a community. Guatemalan midwives bear a large burden as the primary healthcare providers for both mothers and children of all ages, serving as primary consultants for a wide assortment of conditions (Hinojosa, 2004). In some cases, midwives even provide spiritual guidance to women and children (van Dijk, Ruiz, Letona, & García, 2013). One anthropologist describes an elderly midwife who sits on her steps to counsel passersby. She is often heard telling young people, "I brought you into the world—and for what? You need to make something of your life, be a good person" (Rogoff, 2011, p. 285).

There are several established pathways to becoming a midwife. Traditionally, selection into midwifery was "sanctioned by underlying cultural logics that define the social and spiritual requirements that limit potential candidates" (Maupin, 2008). The process required negotiation between the chosen woman, community members, and external spiritual forces. Before recognition, the midwife must undergo a series of social rights of passage—each community may have its own confirmation process which changes with time, necessity, and external pressures from the biomedical and international communities (Maupin, 2008).

Traditional selection usually involves a combination of divine calling and familial background, although communities can elect their own midwives and bypass traditional means to divine selection (Cosminksy, 2001; Paul & Paul, 1975). Divine calling is the most prevalent of these, however, and usually involves dreams, signs, or visions. This calling may also involve a midwife being thrust into an emergency situation that requires her to call on divine assistance. Rather than a choice, midwifery is seen as a pre-destined role and a divine gift that is bestowed

on women of the appropriate temperament (Cosminksy, 2001). As one anthropologist put it, "midwives are born, not made" (Paul & Paul, 1975). Failing to respond to physical or spiritual signs of calling will lead to woman's death or serious harm; similarly, failing to assist in a delivery may also result in punishment by a spiritual agent. Women with mothers who are midwives seem to be more likely to receive this divine calling than the average woman, and as a result, some anthropologists view midwifery as being passed down through generations (Cosminksy, 2001). The combination of a divine calling and the spiritual obligation to assist in delivery grant great authority to traditional midwives.

After recognizing their calling, traditional midwives primarily learn their skill through traditional methods. The selection through spiritual means can actually play a significant role in this education. In the case where a woman is divinely called to midwifery through an emergency situation, having no choice but to help another woman through labor serves as a rapid and immersive training experience. Dreams and visions also reveal essential techniques, with spirits of deceased midwives often acting as guides (Cosminksy, 2001; Paul & Paul, 1975). Informal apprenticeships and midwifery courses provide alternate forms of education. And now with increasing frequency, as will be discussed throughout this paper, the biomedicalization of midwifery is having a significant effect on midwife training by incorporating pedagogical techniques such as informational lectures and use of explanatory diagrams.

Additionally, the spiritual nature of midwifery extends past training, and well into practice. After initial training, many midwives continue to receive assistance from the spirits of dead midwives, who help to correct abnormalities and assist in choosing medicines. Other midwives receive physical signs, such as a twitching between the thumb and forefinger that indicate a difficult birth is coming. Some midwives ascribe this divine assistance to their

Catholic faith, while others attribute it to Mayan deities or simply the guidance of previous generations (Cosminksy, 2001). Traditional midwives are also steeped ritual and ceremony, with the most central aspect of ceremonial care being massage of the patient's abdomen both during and following delivery. The technical purpose of this massage is to relieve pain, speed delivery, and correctly position the fetus, but it also serves to comfort the patient and to build trust between the patient and the midwife. Learning the massage requires astute observation and experience, and is also often guided by spirits of deceased midwives. In this way, the massage epitomizes the midwife's "embodied knowledge," or the synthesis of experience, instruction, and intuition that constitute the foundation of her practice (Cosminksy, 2001). Another important ritual is the post-partum herbal bath, which restores the humoral balance of the woman following delivery, considered a "cold" state. For this reason, the herbs used in the bath are all "hot," in order to return the woman to a neutral state and to stimulate flow of breast milk. This ritual usually occurs three days post-delivery, and is thought to be critical to both the flow and the quality of the milk produced (Cosminksy, 2001).

Beyond the ceremonial massages and herbal baths, midwives' traditional practices also include offering the child to the gods following forty days of "laying in" and interpretation of occult signs that denote the child's destiny (Paul & Paul, 1975). Along with spiritual sanction through their divine calling, the sacralization of these rituals may also help explain why midwives have such significant authority and long-standing trust in the regions they practice (Cosminksy, 2001).

Recent Modernization of Midwives

However, the efforts of the formal healthcare system to medicalize the practices of midwives have challenged this authority, leading to a negotiation of power structures between biomedicine and traditional practices. Medicalization also moves health "from a family concern to a state concern" (Newman, 1981, p. 6). These attempts to modernize the practice of midwifery in Guatemala are not a new phenomenon, as training programs were first established in Guatemala in 1935. Midwives could legally practice as long as they were trained, certified, and met demographic standards (such as being female and having children of her own). However, very little regulation of this system was in place. Ministry of Health and Public Assistance (MSPAS) began offering formal training in 1955, as well as aptitude exams that granted certificates to "lay midwives." These courses were typically taught by a nurse or auxiliary nurse (Cosminksy, 2001). In 1969, the Division of Maternal and Child Health was formed, greatly increasing the numbers of trained midwives to 6000 by 1977. However, very few midwives kept contact with MSPAS after training, leaving weak MSPAS-midwife relations and little MSPAS influence over practice (Maupin, 2008). Similarly, these courses have varied greatly in their structure and content depending on the sponsoring organization, leading to great inconsistency between the knowledge and skills of different midwives (Cosminksy, 2001).

Then in the 1980s, Guatemala adopted the WHO midwifery training model. According to these standards, the nation was required to have a system to register and license midwives, provide training, keep track of neonatal deaths and post-partum tetanus, as well as offer family planning services. By 1985, nearly 7,000 midwives were registered under this program. Despite the apparently high participation, WHO said training lay midwives was seen "increasingly as a failure," as the efforts produced neither improved health measures nor long-term relationships

with midwives. Instead, the organization began advocating the use of more formally trained midwives, such as those recruited by local health authorities rather than by traditional processes (World Health Organization, 2005, p. 70).

In 1990, the world pledged to reduce the maternal mortality ratio by 75% as part of the UN's Millenium Development Goal 5 (MDG5) (Sibley et al., 2004). Partially in response to MDG5, Guatemala implemented Sistema Integral de Atención en Salud (Integrated Healthcare System, SIAS) in 1999 with the aim to reduce infant and maternal morality. The program sought to include midwives in the national healthcare system through more formalized midwifery training programs. Midwives would remain the primary source of care for rural women, but would be subject to greater regulation and enforcement of Ministry of Health policies regarding training requirements.

SIAS sought primarily to address the issues of high fetal and maternal mortality while decreasing health expenditures. As nearly 70% of Guatemala's health resources go to urban hospitals, few resources remain for rural health facilities (Hurtado & Sáenz de Tejada, 2010). The incorporation of midwives would therefore extend the influence of the Ministry of Health into rural regions without extensive expenditure. In the view of health officials, an ideal system would utilize midwives as initial prenatal care providers. The midwives would then refer special cases and patients with complications to biomedical professionals. Officials believed that this system would not overwhelm already understaffed biomedical facilities while still providing care to the high-risk cases that lead to increases in maternal and fetal mortality (Bailey et al., 2002). As many midwives practice in patient's homes with limited supplies and technology, referral is one of the most important practices that can be taught to traditional midwives in training courses. In the words of one midwife: "The best thing about the training courses, they teach me when I

can help women and when I need to send them to the hospital" (Maupin, 2008, p. 374). Many studies on midwives use referral frequency to gauge midwife incorporation into the formal healthcare system, and I will utilize this measure in my own analysis (Bailey et al., 2002; Berry, 2006; Chary, Díaz, Henderson, & Rohloff, 2013; Goldman & Glei, 2003).

Under SIAS, midwives were required to attend courses to achieve certification to both practice and register the births they attended. These official registration forms were collected during the midwife's monthly report to her local health post (Cosminksy, 2001). Without certification, the births that the midwives' attended would not be registered. As this formal documentation is required for the child to obtain government benefits throughout his or her life, public health officials thus sought to decrease the legitimacy and therefore popularity of midwives who were non-compliant with SIAS policies (Maupin, 2008).

Although midwives had already been targeted as subjects of possible modernization through increased training and distribution of supplies, this policy exacerbated medicalization throughout the field. Through SIAS, midwives were called explicitly to help address poor national health outcomes and modernize the health infrastructure. As the primary goal of this modernization was to incorporate midwives into the national health system, the Ministry of Health had intended, with SIAS, to achieve more control over midwives as well as increased access information concerning the rural population (Maupin, 2008).

Mixed Success of Medicalization

Despite governmental action towards midwife modernization, most studies find that programming has proved only marginally effective (Goldman & Glei, 2003; Greenberg, 1982). These results are comparable to the effects of similar interventions seen at a global level. One

meta-study of sixteen studies found a medium, positive, but non-significant association between training and midwife knowledge of risk factors and conditions requiring referral (Sibley et al., 2004). Similarly, a meta-study combining the results of thirty-three papers found that midwife training had no impact on positive midwife practices in some cases, and a small impact on referral in others (Byrne & Morgan, 2011). Other practices of interest include recommending breastfeeding and immunization, and follow-up with patient. These results leave many questions concerning the most appropriate way to improve both practice and patient outcomes for the world's most at-risk obstetric patients.

Therefore, the goal of the following analysis is to determine which midwife qualities (such as education, calling, and having taken a course) have the greatest effect on positive midwife practices such as referral, recommending immunization, and recommending breastfeeding. Similarly, I will investigate the effect of these factors on midwife practices that may have negative patient outcomes, like giving injections to speed delivery, as well as on practices that reflect adherence to traditional beliefs, such as tying the patient's stomach and using prayer or ritual (Goldman & Glei, 2003).

I hypothesize that taking a midwife course will have a positive effect on the following factors: referral frequency, the level of midwife follow-up with patients, recommendations for immunization and breastfeeding, giving an injection to accelerate delivery. I also hypothesize that taking a course will have a negative effect on traditional practices such as tying a patient's stomach, praying for the mother and child, and performing a ritual. I expect these effects to remain after controlling for the length of practice, whether a midwife has had formal education, as well as the way in which the midwife was called to her profession (whether by divine means

or recruitment). My results will add to previous work by examining the effect of midwife calling

and other factors on various practice outcomes across rural Guatemala.

Midwife Study
Methods

EGSF Background

This study uses the Guatemalan Survey of Family Health (EGSF), a data set of interviews conducted in 60 rural Guatemalan communities, 15 in each of the four rural departments. Data were collected between May and October of 1995. The survey focused on children under five years of age and mothers during pregnancy and childbirth. The survey included household interviews with 4,792 households, individual interviews with 2,872 women, and community surveys filled out by various providers in each of the 60 communities. The survey included both quantitative questions and free responses (Pebley & Goldman, 1998).

In contrast to previous ethnographic studies, the EGSF responses span rural regions across Guatemala instead of focusing on a single isolated community (Bailey et al., 2002; Cosminsky, 1977; Lang & Elkin, 1997; O'Rourke, 1995). In this way, my study differs from previous work in that it addresses trends across the entirety of the region as opposed to a phenomenon observed in a particular community. Although the data are for 1995, the trends observed may be indicative of greater trends within midwifery practice in this region, and perhaps in similar rural regions across Latin America where midwives are the primary childbirth attendants.

However, some changes in practices have undoubtedly occurred since that point, and this must be taken into account when considering the results of analysis. Besides the age of the survey collection, the EGSF data is also limited in regards to the number of provider surveys. Although over a hundred providers completed interviews, only sixty-six of these providers were midwives. Therefore, rigorous quantitative analysis is limited by decreased statistical power. Despite these limitations, however, the data and the associations drawn are still useful in

suggesting both significance and direction of effects of various factors on midwives' practices. Likewise, although the data was not recently sampled, many of the relationships between educational factors and practice outcomes are likely still observed. More rigorous sampling will be required to confirm the results suggested by this study, and to obtain the statistical power necessary to detect more of the effects on midwife practices.

Ordinary Least Squares Regressions

Before the EGSF data could be analyzed, I merged the various data files into a single file using STATA. I then used R to re-code certain variables. For the "to whom do you refer" variable, I grouped biomedical professionals (1) and non-biomedical professionals (0). Biomedical professionals included a health post or center, private doctor, clinic, or hospital. Non-biomedical professional was another midwife or other, when specified to be a curer or spiritualist.

For perceived education, I re-coded the responses into "divine" and "non-divine" callings based on the question "How did you learn to do this?" Divine included the following responses: "It was my destiny" and "Revelation in a dream." Non-divine included the following responses: "From parents/ relatives," "From another person," "Empiricism," "Courses and practicums," and "In a situation." Figure 1 shows the distribution of these responses before re-coding.
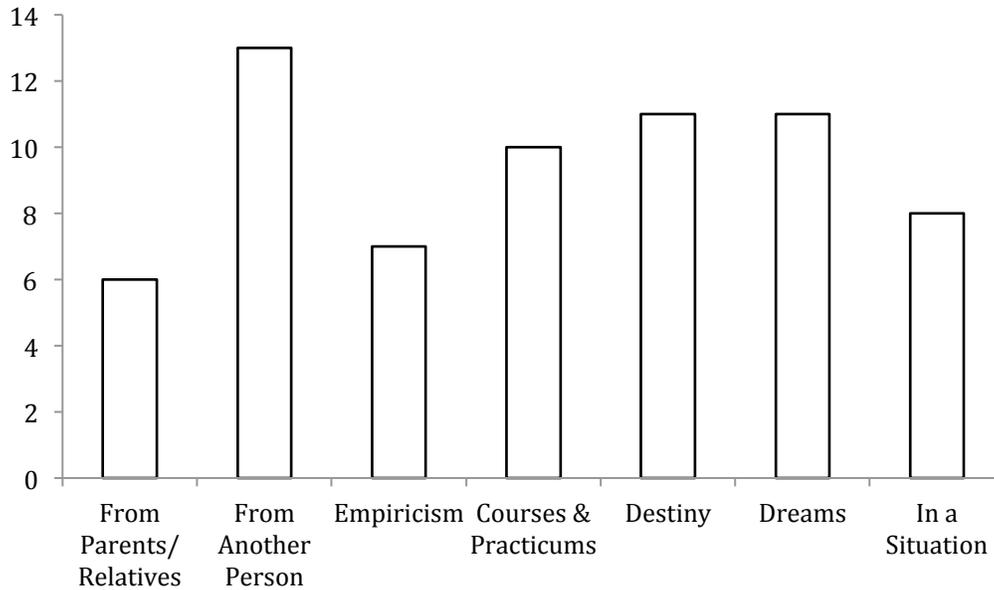
Figure 1: Histogram of Perceived Education Before Re-coding.

The variables in question are a mixture of ordinal, binary, and continuous data. I began with Ordinary Least Square (OLS) regression, which treats ordinal dependent variables as though it they were cardinal. OLS serves as a good approximation of direction and significance. Due to limited statistical power, the coefficient on the binary predictor is less useful than in larger data sets. To rigorously analyze magnitude of effects, a larger data set and more complicated statistical models are required. In the regression tables below, "***" denotes a p-value < 0.001, "**" denotes a p-value < 0.01, "*" denotes a p-value < 0.05, and "." denotes a p-value < 0.1.

Logistic Regressions

Following the OLS regressions, I ran logistic regressions on the variables that were significant to check the robustness of the OLS results. The purpose of logistic regressions is to avoid treating ordinal data as interval level data. However, in order to utilize logistic regressions, dependent variables must be converted into binary data, which required substantive decision-

making concerning the particular variable. I made these decisions by first looking at the histograms and understanding the distribution of the variable. I then considered the practice and determined whether a particular response should be considered "true" or "false."

For referral frequency variable, I coded "Never" and "Almost never" as 0 and "Sometimes," Frequently," and "Always" as 1. For recommending immunization, recommending breastfeeding, prayer, ritual, and stomach tying variables, I coded "Never" and "When necessary" as 0, and "Once in a while" and "Normally" as 1. For using injection variable, I coded "Never" and "Sometimes" as 0, and "Generally" and "Almost Always" as 1. Histograms of many of these variables before coding are provided in the OLS Results section below.

Results

OLS Regressions

One of the most important measures of midwife medicalization is referral frequency. Categorical responses to this variable ranged from Never (1) to Always (5), and frequency is shown in Figure 2. Many studies utilize this measure to indicate how integrated a midwife has become in the formal healthcare system. (Dana A. Glei, Goldman, & Rodríguez, 2003; Goldman & Glei, 2003) Therefore, I began by examining the effect of taking a midwifery course on midwife's referral frequency. When controlling for both level of education and years of midwifery experience, the results suggested a significant positive effect of having taken a course on referral frequency (Table 1). Therefore, midwives who have taken a course are more likely to refer their patients than those who had not taken a course. The adjusted R-squared value for the model is 0.04615, suggesting that most of the variation cannot be attributed to these factors alone. Despite the low r-squared value, the low p-value for the variable of interest (0.03802)

indicates that the effect of course is significant nonetheless. I performed regression diagnostics

for this model and found no evidence of problematic collinearity or heteroscedaticity.

	Estimate	Std. Error	T value	Pr	
(Intercept)	1.75489	0.60133	2.918	0.00492	**
Course	1.24520	0.58716	2.121	0.03802	*
Formal Ed. Level	-0.10122	0.32016	-0.316	0.75297	
Yrs. Exp.	0.01310	0.01222	1.072	0.28779	

Table 1: Results of regression analysis for referral frequency.
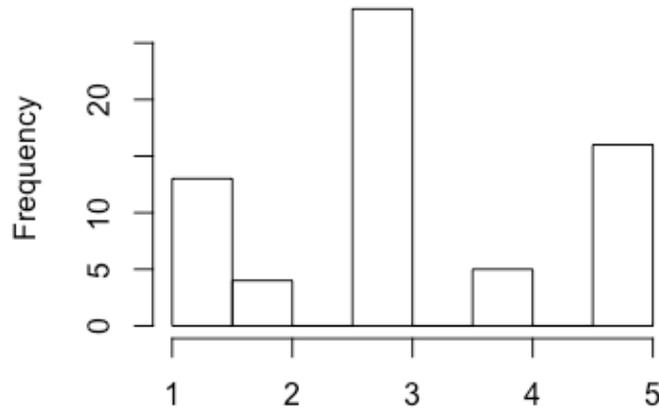"Never" coded as 1; "Always," 5.

Figure 2: Histogram of referral frequency.

I then examined the effect of a midwife's perception of how she gained her expertise. As

discussed above, responses were coded as "non-divine" (0) and "divine" (1). Results suggested a

strong negative effect of perceived education on referral frequency. In other words, midwives

who have a "divine" education are less likely to refer patients to a biomedical professional than

those who believe they gained their skill through non-divine means (Table 2). However, the

effect of having taken a course disappeared when perceived education was added to the model.

Overall, these results suggest that more of the variation in referral frequency can be explained by

midwives' perceived attainment of skills than by whether they have taken a course. The adjusted

R-squared value is 0.1224. I performed regression diagnostics for this model and found no

evidence of collinearity or heteroscedaticity.

	Estimate	Std. Error	T value	Pr	
(Intercept)	2.469843	0.643242	3.840	0.000299	***
Course	0.932588	0.576789	1.617	0.111154	
Perceived Ed.	-0.908077	0.361685	-2.511	0.014763	*
Formal Ed. Level	-0.178818	0.308641	-0.579	0.564507	
Yrs. Exp.	0.008267	0.011874	0.696	0.488945	

Table 2: Results of regression analysis for referral frequency, with perceived education.
"Never" coded as 1; "Always," 5.

I also examined the effect of course, perceived education, level of formal education, and

years of experience on whether a midwife recommended immunization to her patients.

Categorical response for this variable ranged from Normally (1) to Never (4). Results suggested

a significant negative effect of course on the midwife recommending immunization, indicating

that the midwife is more likely to recommend immunization if she had attended a midwifery

course (Table 3). However, unlike referral frequency, whether a midwife believed her skills to be

divinely endowed had no effect on her frequency of recommending immunization.

	Estimate	Std. Error	T value	Pr	
(Intercept)	1.354817	0.173989	7.787	1.13e-10	***
Perceived Ed.	0.095338	0.097832	0.975	0.33371	
Course	-0.471931	0.156015	-3.025	0.00366	**
Formal Ed. Level	-0.014545	0.083484	-0.174	0.86228	
Yrs. Exp.	0.004202	0.003212	1.308	0.19570	

Table 3: Results of regression analysis for frequency of recommending immunization.
"Normally" coded as 1; "Never," 4.

I performed regression diagnostics for this model and found no evidence of collinearity. However, tests for heteroscedaticity indicated that the significance may be due to heteroscedaticity rather than true difference. I re-ran the regression with robust standard errors in R, and the p-value for the course variable rose above the standard threshold for significance. Although this effect does not withstand the test of robust standard errors, this does not necessarily mean that the effect does not exist. Rather, the loss of effect may be a result of limited statistical power due to a low sample size. Creating a histogram of the variable's responses showed that only 1 of the 66 respondents does not "normally" recommend immunization (Figure 3). Therefore, a larger sample size may be needed to gain meaningful information about the educational background of midwives who do not recommend immunization.
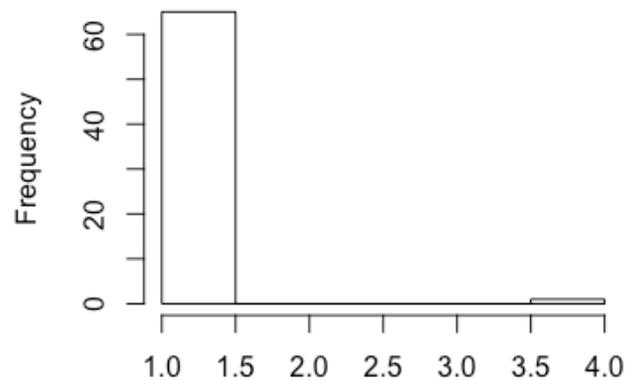

Figure 3: Histogram of Immunization.

I also examined the effect of course, level of formal education, and years of experience on the prevalence of the midwife tying the patient's stomach following delivery. Categorical responses varied from Normally (1) to Never (4). This is a very common practice in the region among indigenous midwives, but is not condoned by biomedical research (Goldman & Glei, 2003; Paul & Paul, 1975), and the current data reflects the regularity of this practice by traditional midwives (Figure 4). When controlling for whether a midwife had taken a course, as

well as for the midwife's years of experience, results suggested a positive effect for years of

formal education, indicating that the midwife is less likely to tie her patient's stomach with more

years of formal education (Table 4). Interestingly, although this practice is traditional in nature,

these results were maintained when controlling for divine calling.

	Estimate	Std. Error	T value	Pr	
(Intercept)	1.055271	0.376762	2.801	0.00685	**
Perceived Ed.	-0.270122	0.211848	-1.275	0.20720	
Course	0.085282	0.337839	0.252	0.80157	
Formal Ed. Level	0.310906	0.180778	1.720	0.09062	.
Yrs. Exp.	0.003650	0.006955	0.525	0.60167	

Table 4: Results of regression analysis for frequency of stomach tying.
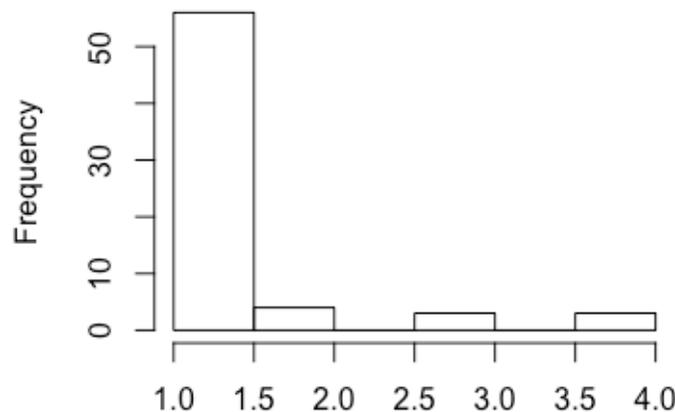"Normally" coded as 1; "Never," 4.

Figure 4: Histogram of Tying Stomach.

I performed regression diagnostics for this model and found no evidence of collinearity.

However, further analysis suggested heteroscedaticity might be a problem. I re-ran the regression

with robust standard errors in R, and the p-value for the course variable maintained below

standard borderline significance levels (0.07122). This suggests that there may be a relationship

between formal schooling and traditional practices, though further research is needed in this area.

I also examined the effect of taking a course, level of formal education, and years of experience on the midwife's frequency of using an injection to speed delivery. Categorical responses varied from Never (1) to Almost Always (4), and frequency is shown in Figure 5. Results suggested a negative effect of course on giving a shot to speed delivery (Table 5). This indicates that midwives who took a course were less likely to give a shot to speed delivery. Results also suggested a positive effect of formal education. This indicates that with formal education, a midwife is more likely to give a shot to speed delivery. However, there is no effect of whether a midwife believed her skills were "divinely" endowed on frequency of using an injection to speed delivery (regression coefficients not shown).

	Estimate	Std. Error	T value	Pr	
(Intercept)	1.683688	0.226658	7.428	5.09e-10	*
Course	-0.796750	0.224298	-3.552	0.000759	***
Formal Ed. Level	0.239162	0.113780	2.102	0.039834	*
Yrs. Exp.	0.003804	0.004383	0.868	0.388899	

Table 5: Results of regression analysis for frequency of giving shot to speed delivery. "Never" coded as 1; "Almost Always," 4.
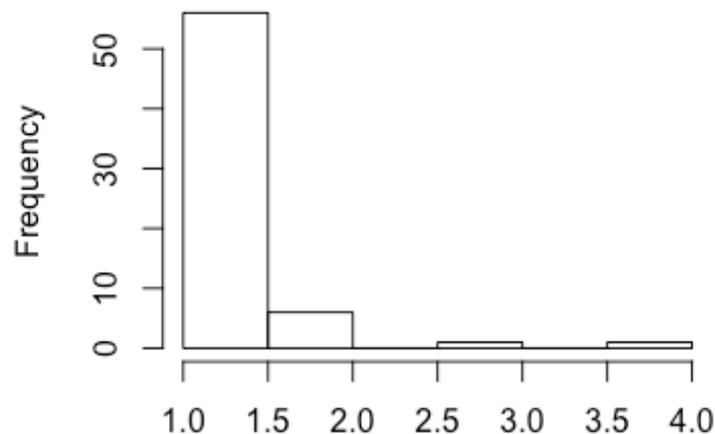

Figure 5: Histogram of Injection to Speed Labor.

I performed regression diagnostics for this model and found no evidence of collinearity. However, tests for heteroscedaticity produced unfavorable results. I re-ran the regression with robust standard errors in R, and the p-value for both the course variable and the level of formal education variable rose above the standard threshold for significance. Although this effect does not withstand the test of robust standard errors, this does not necessarily mean that the effect does not exist. Rather, the loss of effect may be a result of limited statistical power due to a small sample size.

Several studies discussing the integration of midwives into the formal healthcare system indicated that the community preferred midwives who were "called" through traditional means rather than selected and trained by formal health workers (Byrne & Morgan, 2011; Maupin, 2008). Therefore, I examined the effect of perceived calling and education on the number of deliveries that a midwife attended in the past twelve months (Figure 6). I controlled for whether the midwife had taken a course, years of experience, and whether the midwife spoke Spanish.

Accounting for midwife's ability to speak Spanish, divine calling has a strong positive effect on the "busyness" of a midwife (Table 6). Taking a course also had a strong positive effect on busyness of the midwife. This effect was maintained when controlling for years of experience. These results support previous literature that rural women are more likely to seek care from midwives that are sanctioned by their communities. However, because certification using a course is required to legally practice in most areas, midwives who take a course are more likely to have built a good reputation for themselves (Hinojosa, 2004). This phenomenon will be explored in the discussion.

	Estimate	Std. Error	T value	Pr	
(Intercept)	-20.11303	17.29306	-1.163	0.25225	
Perceived Ed.	22.64935	7.87839	2.875	0.00666	**
Course	30.03579	12.48223	2.406	0.02123	*
Spanish?	6.41305	8.22168	0.780	0.44034	
Yrs. Exp.	0.03269	0.24882	0.131	0.89617	

Table 6: Results of regression analysis for number of deliveries attended in 12 months.
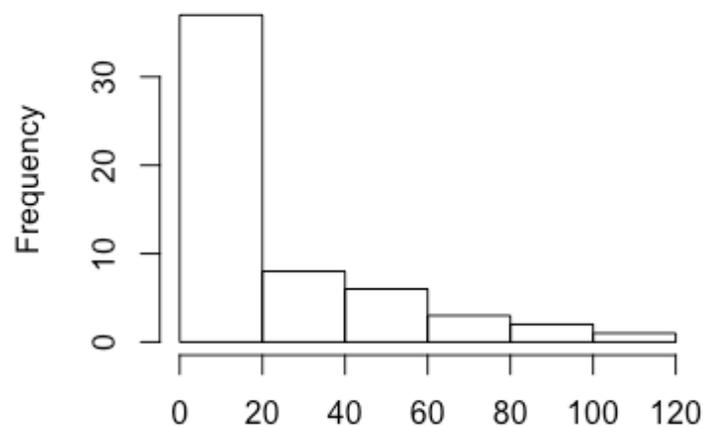

Figure 6: Histogram of Number of Births Attended in 12 Months.

I performed regression diagnostics for this model and found no evidence of collinearity. However, the model again had a heteroscedasticity problem. I re-ran the regression with robust standard errors in R, and both the p-value for the course variable and for perceived education remained below the standard threshold for significance, indicating that these effects were not due to heteroscedaticity.

Although many of the variables analyzed were significantly affected by various educational factors, many regressions also yielded no significant results. Having taken a course had no effect on keeping the baby warm after birth, recommending breastfeeding, midwife performing a prayer or ritual (even when accounting for divine calling), following up with the

mother or child, or giving a shot to ease pain. Similarly taking a course was found to have no

effect on whether the midwife cleaned the child, as all midwives reported doing this practice.

However, as indicated above, lack of significance does not provide assurance that an

effect does not exist. Although these data don't give us significance to reject the null hypothesis,

this may be due to low degrees of freedom and resulting limited statistical power. More rigorous

analysis and conclusions would require a larger sample size.

Logistic Regressions

The following analysis served to check the robustness of the OLS results. For referral

frequency, I recoded "Never" and "Almost Never" as 0, and "Sometimes" and "Frequently" as 1.

Using logistic regression, there is no evidence that course, formal education level, or years of

experience has an effect on referral frequency (Table 7). This deviates from the results of the

OLS regression, where course had a significant positive effect on referral frequency.

	Estimate	Std. Error	T value	Pr	
(Intercept)	-0.77120	0.98585	-0.782	0.434	
Course	1.00872	0.91528	1.102	0.270	
Formal Ed. Level	0.55687	0.59936	0.929	0.353	
Yrs. Exp.	0.03399	0.02542	1.337	0.181	

Table 7: Results of regression analysis for referral frequency.
Never or almost never referring is coded as 0; sometimes or frequently referring, 1.

When the model is altered to account for calling, perceiving skills as "divinely" attained

had a significant negative effect on referral frequency (Table 8). The effect is in the same

direction as the OLS regression, providing support for the initial observation that midwives who

believe themselves to be divinely called refer less often than those who are not divinely called.

	Estimate	Std. Error	T value	Pr	
(Intercept)	0.49278	1.15849	0.425	0.6706	***
Perceived Ed.	-1.66156	0.64894	-2.560	0.0105	*
Course	0.53918	0.97202	0.555	0.5791	
Formal Ed. Level	0.48670	0.64131	0.759	0.4479	
Yrs. Exp.	0.02740	0.02706	1.013	0.3113	

Table 8: Results of regression analysis for referral frequency, with perceived education. Rarely or never referring coded as 0; sometimes or often referring, 1.

Despite having a significant positive effect in OLS regression, using logistic regression level of formal education had no significant effect on frequency of recommending immunization. This is likely due to the lack of variation in responses, as nearly all midwives recommend immunization, giving very few cases from which to determine cause of variation. A larger sample size may give more statistical power over this question.

Similarly, level of formal education had no significant effect on recommending immunization using logistic regression, although effects were seen using OLS. As before, the absence of effect may be due to the lack of variation in responses. Because almost all midwives reported recommending immunization, there are very few responses from which to measure variation.

Finally, logistic regression results indicate that course has a negative effect on using injection to speed delivery (Table 9). This is the same effect as evidenced in the OLS regression, and suggests that women who take a course are less likely to use injection to speed delivery. Level of education has a positive effect on using injection to speed delivery, which also reflects OLS results and suggests that women with more formal education are more likely to use injections to speed delivery. These results are surprising, as one would have assumed that both formal education and the government course would affect the frequency of using an injection in

the same direction. As using injection to speed delivery is typically not condoned by the biomedical profession, this effect of formal education is concerning. A possible explanation for this result is that because midwives who have taken a course are more likely to refer (as indicated by previous results), the midwives are more likely to have already referred a patient with complications before she required this treatment. However, as formal education level does not appear to have an effect on referral frequency, this effect does not occur for the formal education variable.

	Estimate	Std. Error	T value	Pr	
(Intercept)	-3.12975	2.43842	-1.284	0.1993	
Course	-4.61423	2.27178	-2.031	0.0422	*
Formal Ed. Level	3.10250	1.72292	1.801	0.0717	.
Yrs. Exp.	0.03454	0.08145	0.424	0.6716	

Table 9: Results of regression analysis for frequency of using injection to speed delivery. Rarely or never using injection coded as 0; sometimes of often using, 1.

As with the OLS results, lack of significant results from logistic regression does not necessarily indicate that no effect exists. Rather, the failure to achieve significance may be due to low statistical power, or in the case of certain variables, missing values. However, the responses that are missing are most likely not randomly skipped. Regardless of the reason, a larger sample size is needed to better understand the effects of education on midwife practices.

In agreement with my OLS models, calling had no significant effect on midwife recommending breastfeeding or using either prayer or ritual (regression estimates not shown). For prayer, the lack of effect may occur because the majority of midwives (56 of the 65 surveyed) pray for their patient regardless of calling or education. The lack of effect of calling on performing a ritual is more surprising, as there was a large variation in whether midwives

utilized ceremony. Again, this may be due to the absence of an effect, or limited statistical power (63 degrees of freedom for ritual variable).

Discussion

Midwives are deeply embedded in the communities in which they serve, garnering a great amount of trust and respect. One reason the position is so highly esteemed is the divine selection responsible for placing many women in the role. The most important results of the current study illustrate the profound effect that this calling has on both midwife practices and the frequency of utilization of a particular midwife within her community. This discussion will address this effect and its implication on future biomedical intervention throughout the region.

Midwife "Calling"

The necessity of recruitment as a means to increase the numbers of practicing midwives began with the implementation of SIAS in 1999, as the policy required more midwives in rural areas than divine calling could provide. Along with recruitment by Ministry of Health officials, democratic election into the role of midwife also became increasingly prevalent and deliberate. Biomedical professionals then trained these midwives, bypassing traditional methods of divine selection and training. Note that this form of complete midwife training differs from the "courses" that we refer to throughout this study, which are typically comprised of several sessions and are much less comprehensive than the training experienced by midwives that receive their full education through the Ministry of Health. Besides increasing the numbers of practicing midwives, recruitment also serves to create a younger set of midwives compared to those who are divinely called, who typically assume their roles at the end of their childbearing

years. These younger midwives "can do more and learn more," according to a SIAS staff in one NGO. "It's tough to work with the older ones. They don't listen to us. They think that because they are older, or rather, because of their experience, that they can do anything… It's difficult to integrate their work with ours. We learn from the doctors, we take classes… But they think they can do it all" (Maupin, 2008, p. 364). Compared to the older midwives, many who are divinely called, the younger midwives more readily adopt Ministry of Health policies as standard practices. However, despite these policy changes, both divine election and traditional means of training are still prominent in many communities (Maupin, 2008).

These excerpts cogently illustrate the first result of the current study, that divine calling has a negative effect on referral frequency. This effect suggests that midwives who are divinely called perceive their routines as more appropriate or effective than biomedical practices, rendering referral unnecessary. These midwives gain their power from spiritual sources, which have more influence than that of the health officials and nurses attempting to enforce SIAS policies. This effect of decreased referral may also reflect the supportive and non-hierarchical nature of the traditional midwife-patient relationship, which is somewhat incongruous with the midwife demanding that the mother see another provider (Rogoff, 2011). In the traditional midwife-patient relationships, the care cycle includes mutual decision-making and communal efforts that often include many family members. In contrast, health workers urge midwives to use their expertise to enforce SIAS policies and further their practice (Cosminksy, 2001).

Positioning theory may help explain how the midwife views herself and her practices in relation to other medical professionals. The theory proposes that the incorporation of new ideas depends not only on the quality or helpfulness of the ideas themselves, but also on the situation of the ideas within an existing conceptual framework of traditional practices (Baert, 2012, p.

304). For example, when determining which practices to incorporate, midwives must often choose between conflicting sources of information. Positioning theory can also be applied to the situating of people within existing institutional hierarchies, which is based on rights and duties as well as on perceived relevant attributes (Harré, Moghaddam, Cairnie, Rothbart, & Sabat, 2009). In the case of Guatemalan healthcare, my results indicate that midwives position themselves above biomedical professionals, as evidenced by the rejection of biomedical principles such as referral and immunization. This positioning is likely due to a midwife obtaining her authority primarily from spiritual and community resources that are deemed more significant than the governmental or educational authority claimed by the health workers attempting to alter her practices. Therefore, because of the spiritual and communal sources of her authority, a midwife is unlikely to adopt new practices proposed by agents of the formal healthcare system that do not coincide with her existing conceptual framework. Health authorities must acknowledge this fact in designing curriculums that respect the views and understandings of the students for which they are designed.

Alternatively, the result of decreased referral frequency by midwives who are divinely called could be interpreted as support of my original hypothesis that based on their experience with the formal healthcare system certain midwives may simply be less comfortable interacting with biomedical professionals. This discomfort would limit midwives' willingness to refer. However, the negative effect of calling persists when controlling for having taken a course, suggesting that uneasiness with biomedical professionals does not constitute the primary explanation for the effect of divine calling.

Explanations for Ineffectiveness of Courses

The results of this analysis questions why training courses do not have a more significant effect on referral frequency compared to calling. One explanation is the lack of integration of midwives with the formal health system (Byrne & Morgan, 2011). Beyond simply providing knowledge, teaching skills, and making midwives more comfortable with medical professionals, midwife training must also directly connect midwives with both health providers and health facilities. Many midwives are uncomfortable with hospitals, as they are thought of as places where people die, and those who do not die are berated by physicians and nurses (Brad Huber, Toribio Martínez, & Sandstrom, 2011). However, providing positive interactions with both physicians and nurses through courses can lower anxieties regarding biomedical facilities. This is particularly true when those administering courses are from the facilities to which the midwives would refer, or if training courses include tours of a nearby hospital (Darmstadt et al., 2009). In this way, midwives make personal connections with the biomedical facilities to which they will refer patients, increasing confidence in the capabilities of the formal healthcare system.

The mediocre effect of courses may also be due to characteristics of the courses themselves. Trainings are based on the WHO's Safe Motherhood paradigm, which espouses that infant mortality can be reduced by care during all points of pregnancy, timely identification and referral of complications, and access to high-quality emergency care (World Health Organization, 2005). Trainings focus particularly on identification of complications and encouragement of referral. The midwife receives approximately $6.50 for each monthly course (Maupin, 2008).

Although the financial incentive to attend the trainings likely improves turnout, the trainings themselves are not best suited to the students. Courses generally utilize Western

pedagogical methods and are often taught in Spanish instead of the Mayan dialects which are the primary languages of most midwives (Maupin, 2008). Similarly, widespread illiteracy among rural Guatemalans renders useless many Western pedagogical methods (Hinojosa, 2004). As one midwife, Chona, recounted: "I watch what the doctor writes, but I don't understand, because I don't know how to read and I don't understand Spanish" (Rogoff, 2011, p. 237).

Similarly, the demographics and skill of instructors can have a profound impact on the acceptance of the information by the midwives. Instructors are often male or unmarried women, which undermines midwives' experience-derived authority. As a result, many midwives do not respect the instructor and the information he or she presents. In contrast, female clinicians with children of their own, teaching experience, and excellent communication and inter-personal skills are much more likely to have positive outcomes on the midwives. These women are able to use their personal narratives and experience to inform their practice, and foster a non-hierarchical relationship with the midwives (Foster, Anderson, Houston, & Doe-Simkins, 2004; Rogoff, 2011). One study showed that training health workers in collaboration techniques significantly increased the referral frequency of their midwife patients (Islam & Malik, 2001). Likewise, for training to have an impact it must be accompanied by consistent follow-up with students, such as biannual refresher courses that will positively reinforce new techniques (Brad Huber et al., 2011; Kruske & Barclay, 2004).

Finally, courses may also over-emphasize academic knowledge instead of practical skills. Pedagogical techniques that include formalized "best practices" and theoretical models may not align with midwives' actual experience. This is particularly true when diagrams are used to communicate with people not familiar with the convention of diagrams. When one midwife was asked what she thought about a lesson concerning the fertilization of an ovum by spermatozoa,

she replied, "it was rather interesting, particularly the part about the ball and the little sticks" (Jordan, 1989, p. 928). Often such courses do not offer hands-on practice of new skills, nor sufficient numbers of personnel to supervise the active instruction. Previous ethnographic work suggests that a demonstrative and participatory approach to skill-building has resulted in greater acceptance of ideas (Rogoff, 2011, p. 243).

In contrast to Western lesson "delivery," traditional training methods emphasize personal knowledge, narrative, and experience, which resonates with the way in which Guatemalan midwives view their practice (Maupin, 2008). These women gain knowledge slowly through observation and contribution, and then pass the understanding through generations, from a midwife to her divinely-called daughters or grand-daughters (Rogoff, 2011, pp. 244–255). Instead of honoring this empirical knowledge, courses seek to reduce midwife confidence in her traditional practices while replacing those practices with biomedical ones (Hinojosa, 2004).

Thus, a conflict exists between the theoretical knowledge presented and the midwives' empirically derived knowledge. This reduces midwife acceptance of biomedical ideals, practices and standards. Experienced midwives can use their own narratives to validate their practice and challenge the authority of biomedical professionals (Maupin, 2008). In order for courses to reach optimal effectiveness, biomedical knowledge and practices must be taught in a way that can be interpreted within traditional practices and cultural logics. It is the ability to teach within these constructs that determines the acceptance of new practices and beliefs (Maupin, 2008, p. 365).

Changing Roles of Midwives

Despite the evidence that traditional methods still play a prominent role in current midwife practices, it would be inaccurate to omit discussion of the changing roles of midwives

due to exogenous attempts to alter both recruitment and medical practices of midwives. The foremost of these changes is the secularization of midwifery. As both methods of selection and medical practices change, so do the identities of midwives. Although much of this change is positive in terms of improved patient outcomes, there are also several negative effects of medicalization. In many communities, birth is a means of expressing both the culture's biosocial system and the culture's ways of knowing. Therefore, as birth is medicalized, indigenous peoples are more disconnected and marginalized from the communal and cultural experience of birth (Gonzales, 2012).

Similarly, denigration of indigenous knowledge occurs through increasing the authority of biomedical paradigms. Traditionally, the "sacralization" of the birthing process provided authority for the midwife's practices and demands (Cosminksy, 2001). Increasing presence of and regulation by the formal healthcare system has diminished divine authority in favor of biomedicine. Young, recruited midwives play an integral role in this process, as they accept new forms of education and supplant older midwives who adhere solely to traditional practices. Changing the source of midwife knowledge from spiritual to empirical also changes the source of midwife authority (Maupin, 2008). Where divine calling used to provide the primary source of authority and protection, formal certification and bureaucratic formality now predominate.

This shifting source of authority has allowed midwives somewhat more power over their own practice. Midwives are increasingly encouraged to adopt greater influence with their patients by choosing which patients they accept and demanding that patients follow orders. This reflects the departure from the suggestive recommendations common in traditional practice to an increasingly biomedical model of healthcare, and it is also reflective of the midwives' own submission to the formal healthcare system through SIAS. This ability to deny patients also

defies traditional beliefs that a spiritually-called midwife has a divine mandate to provide

services for any woman in need, therefore redefining the authority and obligation of the midwife

within her community (B. Huber & Sandstrom, 2001).

Utilization of Recruited Midwives

Despite the secularization that is undoubtedly occurring, many traditional communities

are hesitant about adopting new medical paradigms. This introduces a second result of the

current study, that the "calling" of a midwife has a significant effect on her level of busyness. It

has previously been suggested that midwives with exclusively biomedical training (not divinely

called or with traditional training) may be less likely to be utilized by their community. Analysis

of the EGSF study indicates that this is the case. This is likely due to community members not

trusting or respecting the authority of the modern midwife as much as the midwife that is

traditionally selected (Maupin, 2008).

Many midwives interviewed with exclusively SIAS training had very little experience.

This demonstrates that rural Guatemalan mothers still prefer midwives who were recruited and

trained via traditional means. Younger midwives who do not "fulfill traditional requirements for

selection to the position are not generally accepted within their communities" (Maupin, 2008).

Therefore, experienced midwives will not be supplanted unless mothers begin to prefer SIAS-

trained midwives. Even though training courses alone can certify these midwives to practice,

both medical training and adherence to traditional selection requirements are required for a

successful career as a midwife.

However, midwives are increasingly legally subordinate to SIAS, as their certification

depends on their willingness to refer patients with complications. Therefore, a conflict exists

between ensuring the appropriate numbers of midwives are trained to serve a population, and respecting the preferences and cultural expectations of the mothers themselves. This again emphasizes the necessity to implement training programs that utilize more culturally appropriate pedagogy.

The effect of divine calling on busyness—or, why mothers choose midwives instead of biomedical professionals— may be in part explained by cultural identity theory. This theory views cultural identity as the "negotiation of social identifications by group members in particular settings." These identities are socially constructed, extremely flexible, and not strictly confining. Which identities prevail at a particularly moment depends on status levels, histories, and degrees of agency of the individual (Chen & Collier, 2012, p. 45). As a result, the identities of individual mothers likely play a role in determining which form of provider is chosen. Mothers likely look for a delivery attendant that reflects aspects of her own cultural identity and in whom she trusts. However, cultural identities are fluid, and the choices of mothers are likely not resistant to change. Similarly, traditional providers can undoubtedly maintain aspects of her cultural identity that allow association with community members while still espousing the medicalized practices that can lead to better patient outcomes.

Socioeconomic and Cultural Factors

Although training midwives who refer patients with complications is extremely important, whether a patient actually receives the necessary care is a separate issue. For example, even if a midwife refers a patient, a high-quality medical facility and specialists may not be available to treat the complications. Likewise, the mother's personal situation may prevent travel to a hospital or clinic. As a result, referral alone may not be a good predictor of actual

improvement in maternal and fetal health outcomes. This emphasizes the difficulty of studying, in isolation, the effects of various efforts on the positive practices of midwives.

Despite this difficulty, ethnographers have identified a variety of personal traits and context-specific barriers that may impact a patient's ability to see a biomedical professional. When woman do not go to the hospital, it may be due to husband's jealousy of male doctors, embarrassment, or fear of ethnic and social discrimination (D.A. Glei & Goldman, 2000; Dana A. Glei et al., 2003). Communication and language barriers, poor quality of treatment, limited hours, and economic barriers are also frequency deterrents. For example, although average daily wage was $3.33 at the time of the study, costs for ride to the hospital are an average of $6.75 and can go up to $40 (Maupin, 2008). In extreme cases, local political unrest and guerilla violence may even discourage mothers from complying with a referral (Bailey et al., 2002).

Recommendations

These socioeconomic and cultural factors must be taken into account when proposing systemic changes. Globally, the best patient and practice outcomes are seen when integration of midwives into the formal healthcare system is combined with other policy implementation that improves accessibility, such as staffing health centers with bilingual providers and establishing health centers in underserved regions. The modes that should be used to improve access to skilled biomedical providers depend both on the demographics of the specific region and on the functionality and capacity of the existing health system (Byrne & Morgan, 2011).

Beyond addressing cultural and socioeconomic factors, the current study suggests that despite increasing medicalization, the nature of a midwife's "calling" has a profound effect both on midwife practice and utilization of the midwife by a community. Therefore, SIAS must

continue with the integration of midwives into the formal healthcare system with the understanding that certain traditional practices, such as divine selection, are preferred to more contemporary practices, such as democratic election or recruitment of midwives.

With this in mind, SIAS should encourage the traditional selection of midwives, or at the least, not discourage it. This may help to maintain the number of midwives within a community as experienced midwives pass away or retire. For midwives that are recruited, SIAS should encourage the traditional forms of training to accompany biomedical training, increasing the likelihood that recruited midwives will be utilized by the community. Similarly, SIAS trainers should maintain a connection with midwives even after courses are completed (Foster et al., 2004). As midwives are the primary link between obstetric patients and the formal healthcare system, strengthening this relationship is crucial to increasing midwife referral in the face of serious complications.

Finally, courses should utilize techniques that reflect traditional training methods, such as using personal narrative, hands-on demonstration, and apprenticeship as primary pedagogical tools. Similarly, instructors should be experienced clinicians with children of their own. These instructors should not degrade traditional knowledge as problematic or a "barrier," but rather seek to supplement existing positive practices with new techniques.

Future Studies & Conclusion

This work identifies several directions for future research. The foremost of this work is investigating how to best accommodate divine calling in midwife education. The results of the current study suggest that midwives selected for the profession by traditional means have the advantage of greater demand by the communities in which they practice, presumably indicating

greater levels of community trust for midwives than biomedical professionals. However, these midwives are less likely to become incorporated in the formal healthcare system, as indicated by their decreased referral frequency. Therefore, future work should seek to elucidate the techniques that are successful in increasing midwife cooperation with biomedical professionals, regardless of whether the midwife was divinely called. This may involve piloting improved training curriculums that include yearly follow-up courses, and performing a longitudinal study on the effect on the midwives practices.

Other researches have suggested the necessity of full random control trials to gain more definitive knowledge regarding the effects of bio-medicalization (Sibley et al., 2004). Rather than focusing on the midwife's training's effect on referral, researchers should adopt a broader perspective that also acknowledges the social and economic factors that affect treatment. The final decision for referral depends on balance of effort and resources needed to go to facility and the perceived benefit of treatment at the facility. This implicates factors such as perceived quality of care, perceived risk, severity of condition, local understanding of cause, and value placed on women's life.

Finally, from a broad perspective it appears that different variables have different predictors. For example, my results suggested that perceived education was a better predictor of referral frequency whereas having taken a course was a better predictor of recommending immunization. Similarly, formal education was the best predictor of whether a midwife tied her patients' stomch. Likewise, some variables aren't affected by education or experience at all, but rather are practiced by most midwives. According to this preliminary survey, the variation seems to be random, likely reflecting the effect of variables not accounted for in my model. However,

future studies with greater statistical power may be useful in determining broader patterns in the effect of various forms of education.

In conclusion, the current study suggests that divine calling has a significant negative effect on referral frequency even when controlling for whether a midwife took a course. Communities value this divine calling and are more likely to utilize a midwife who is selected to the profession in this way. As a result, integration of midwives into the formal healthcare system must account for the powerful role of traditional selection methods in the many rural communities, and should seek to recognize the authority of midwives through collaborative and non-hierarchical trainings.

Household Study

The results of the midwife study indicate that whether a midwife is divinely called has a profound effect on both her referral frequency and her utilization by her community. These results raised more general questions regarding the effect on maternal practices of having a midwife versus a biomedical professional attendant. In other words, does having a midwife in attendance at her birth incline a mother towards breastfeeding for a longer period of time, or towards an increased likelihood of vaccinating her children? Addressing these questions will also address whether efforts to make use of existing pools of midwives to disseminate medical beliefs will further the goals of the Ministry of Health. This section of the study will seek to address such questions through examining factors that are predictors of maternal health practices.

Methods

The EGSF data used for the analysis of midwife practices also contains a section of maternal responses. These responses were taken from interviews with 2872 women aged 18 to 35 in the same four rural departments as the midwife data, which covered detailed maternal and child health information, as well as personal background, health beliefs, and social and economic status (Pebley & Goldman, 1998).

The following analysis covers four main categories of maternal practices: breastfeeding, follow-up visits with a provider, immunizations, and health beliefs. As length of breastfeeding is a continuous variable, ordinary least squares regression analysis was utilized. For the other analyses, logistic regression was used. One variable, which type of provider attended birth, required re-coding to fit a logistic regression. For this variable, I coded midwife as 0 and biomedical professional as 1.

For each regression, controls included ethnicity, age, and number of children. The survey does not ask the respondents to report income, so I chose to use whether or not the house has electricity as the best available proxy. Although I planned to control for maternal education level as well, the degrees of freedom were nearly cut in half by missing responses. Therefore, I included the results of the regressions run with the maternal education control after each general result. Ethnicity was treated as a categorical variable, with categories as indigenous (reference), Ladina, both indigenous and Ladina ("A little of both"), and no distinction.

Results

I began by using an OLS regression to examine the effect of provider on how many months a mother breastfed her child, with controls for age, ethnicity, number of children, and whether a household has electricity.

	Estimate	Std. Error	T value	Pr	
(Intercept)	12.09925	2.03704	5.940	4.87e-09	***
Attendant	-3.30113	0.75956	-4.346	1.63e-05	***
Age	0.40665	0.09041	4.498	8.27e-06	***
Eth: Ladina	-3.17450	0.63731	-4.981	8.31e-07	***
Eth: Both	-4.11520	2.39790	-1.716	0.086655	.
Eth: No distinction	-2.45989	5.24746	-0.469	0.639402	
Number children	-0.84144	0.23097	-3.643	0.000293	***
Electricity	-0.02735	0.63170	-0.043	0.965474	

Table 10: Results of regression analysis for number of months mother breastfeeds.
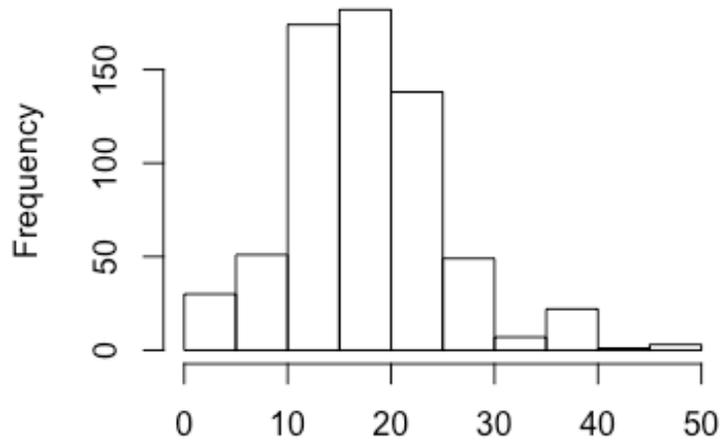
Figure 7: Histogram of Number of Months Mothers Breastfeed.

Results suggest that attendant has a significant negative effect on how long a mother breastfeeds (Table 10). Therefore, women attended by midwives are likely to breastfeed for a longer period of time. Similarly, older women appear to breastfeed for longer periods of time, and women with more children appear to breastfeed for shorter periods of time. Ladina and women who identify as both indigenous and Ladina are likely to breastfeed for fewer months than indigenous mothers. When accounting for number of years of primary education, degrees of freedom dropped to 359 but each of the effects described above remained the same. Number of years of primary education had a significant positive effect, suggesting that women with more years of primary education are more likely to breastfeed for more months.

Using the same controls as above, I then examined the effect of attendant on whether a mother breastfed at all using a logistic regression.

	Estimate	Std. Error	T value	Pr	
(Intercept)	4.06197	1.13432	3.581	0.000342	***
Attendant	-1.44697	0.41245	-3.508	0.000451	***
Age	0.02765	0.05291	0.523	0.601221	
Eth: Ladina	-0.70674	0.39469	-1.791	0.073358	.
Eth: Both	0.03313	0.13698	0.242	0.808874	
Eth: No Distinction	13.53451	784.44917	0.017	0.986234	
Number children	0.03173	0.13707	0.231	0.816961	
Electricity	-0.07126	0.39176	-0.182	0.855672	

Table 11: Results of regression analysis for whether a mother breastfeeds.
Not breastfeeding coded as 0; breastfeeding, 1.

Results suggest that attendant has a significant negative effect on whether a mother breastfed (Table 11). This indicates that women who were attended by midwives were more likely to breastfeed than those attended by biomedical professionals. There is also a negative effect that suggests Latina women were less likely to breastfeed than their indigenous counterparts. When accounting for number of years of primary education, the positive effect of attendant was maintained, and actually became more negative.

I then examined the effect of provider on whether mother received a follow-up visit using a logistic regression and the same controls as above.

	Estimate	Std. Error	T value	Pr	
(Intercept)	0.480350	0.336266	1.428	0.15315	
Attendant	0.199316	0.157143	1.268	0.20466	
Age	0.011639	0.015611	0.746	0.45593	
Eth: Ladina	0.378848	0.123083	3.078	0.00208	**
Eth: Both	-0.858736	0.420911	-2.040	0.04133	*
Eth: No Distinction	-1.169034	1.423032	-0.822	0.41136	
Number children	0.001654	0.037512	0.044	0.96482	
Electricity	0.147698	0.110264	1.339	0.18041	

Table 12: Results of regression analysis for whether mother receives follow-up visit. No follow-up visit coded as 0; follow-up visit, 1.

Results suggest no significant effect of attendant on whether mother received a follow-up visit (Table 12). However, Ladina ethnicity has a significant positive effect, suggesting that Ladina mothers are much more likely to receive follow-up visits than indigenous mothers. Women who identify as both Ladina and indigenous are less likely to receive a follow-up visit than indigenous mothers. When accounting for years of primary education, the positive effect for Ladina mothers was maintained, but the effect for mothers that identify as both was not. Additionally, years of primary education had a positive effect at the $p<0.1$ level, suggesting that mothers with more education are more likely to receive a follow-up visit.

I then examined the effect of provider on whether infant received a follow-up visit using a logistic regression and the same controls as above.

	Estimate	Std. Error	T value	Pr	
(Intercept)	0.34221	0.34571	0.990	0.3222	
Attendant	0.27088	0.16465	1.645	0.0999	.
Age	0.02535	0.01611	1.573	0.1156	
Eth: Ladina	0.57780	0.12996	4.446	8.74e-06	***
Eth: Both	-0.55591	0.43340	-1.283	0.1996	
Eth: No Distinction	12.32599	378.58884	0.033	0.9740	
Number children	-0.03288	0.03844	-0.855	0.3924	
Electricity	-0.02604	0.11267	-0.231	0.8172	

Table 13: Results of regression analysis for whether infant receives follow-up visit. No follow-up visit coded as 0; follow-up visit, 1.

Results suggest that type of attendant has a positive effect on whether an infant received a follow-up visit at the p<0.1 level (Table 13). Therefore, if a biomedical professional attended the birth, a follow-up visit with the infant is more likely. Results also suggest a significant positive effect on Ladina ethnicity, suggesting that children of Ladina women are more likely to receive a follow-up visit than children of indigenous women. When accounting for years of primary education, the positive effect of Ladina ethnicity was maintained. There was also a positive effect of years of primary education at the p<0.1 level, suggesting that mothers with more years of primary education are more likely to have children that receive follow-up visits.

Immunization Index

I then examined whether midwife attendance had an effect on whether the child received vaccinations. The interview included questions regarding whether or not the child had received five essential vaccinations: polio, DPT, BCG, measles, and other. To examine the effect of attendant on how many of the vaccinations the child received, I created an immunization index

that counts the number of vaccinations for each respondent. Respondents with any missing values were excluded from the index.

	Estimate	Std. Error	T value	Pr	
(Intercept)	4.283042	0.114503	37.405	< 2e-16	***
Attendant	-0.054928	0.048253	-1.138	0.25519	
Age	0.014758	0.005289	2.790	0.00534	**
Eth: Ladina	0.107342	0.038602	2.781	0.00550	**
Eth: Both	0.261737	0.141716	1.847	0.06498	.
Eth: No distinction	0.390662	0.453138	0.862	0.38877	
Number children	-0.025670	0.012858	-1.997	0.04608	*
Electricity	0.017406	0.036583	0.476	0.63430	

Table 14: Results of regression analysis for infant immunization index.

Results of the OLS regression indicated no effect of attendant on the number of vaccinations; however, age of mother had a positive effect on the index, suggesting that children of older mothers are more likely to receive greater numbers of vaccinations (Table 14). Ladina ethnicity also had a positive effect, suggesting that children of Ladina mothers are likely to receive more immunizations than the children of indigenous mothers (the reference group). Finally, number of children had a negative effect, suggesting that mothers with greater numbers of children are likely to receive fewer vaccinations.

When controlling for years of primary education, the effects on age and Ladina ethnicity were maintained. The effect of number of children was reduced to an effect at the $p < 0.1$, and the effect on "both" ethnicity was no longer seen. Note that the degrees of freedom was reduced from 1321 to 799 when controlling for years of primary education.

Health Beliefs

I also examined the effect of attendant on a woman's health beliefs. In the interview, this question described a child's illness, and asked the mother why the child had become sick. I have re-coded maternal responses into traditional (0) and biomedical (1) causes of illness (Figure 8). When both traditional and biomedical causes were cited, I favored the biomedical response, as this indicates the potential effect that a biomedical provider may have had on the patient. The traditional causes include: evil eye and evil spirit, susto (fright), air and sun, empacho, and too much heat or cold. Biomedical causes include: infection, malnutrition, ate something bad or too much, weakness, inadequate care, worms, dirty hands, season of illness, insects or animals, dust, cough, and microbes. "Other" (n=23) was coded as a traditional cause.

	Estimate	Std. Error	T value	Pr	
(Intercept)	0.66823	0.47820	1.397	0.16230	
Attendant	0.44995	0.23105	1.947	0.05148	.
Age	0.03289	0.02213	1.486	0.13720	
Eth: Ladina	0.08917	0.16546	0.539	0.58992	
Eth: Both	-0.40811	0.57201	-0.713	0.47556	
Eth: No distinction	11.17069	378.58841	0.030	0.97646	
Number children	-0.04398	0.05183	-0.848	0.39616	
Electricity	0.43344	0.15495	2.797	0.00515	**

Table 15: Results of regression analysis for maternal health beliefs
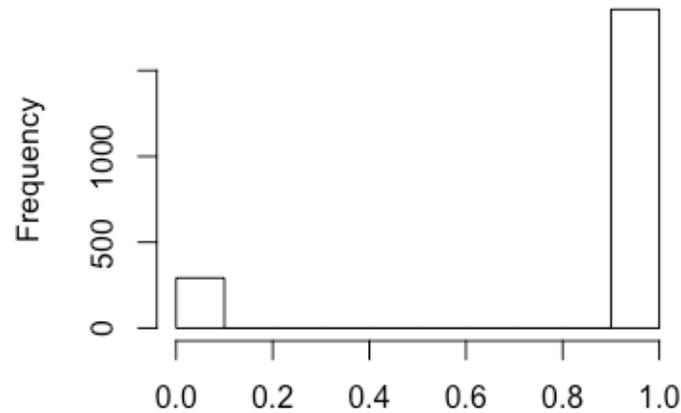Traditional disease-sources coded 0; biomedical sources, 1.

Figure 8: Histogram of Health Beliefs.

Results suggest a positive effect of attendant on health beliefs of the mother at the $p<0.1$ level (Table 15). This indicates that mothers attended by a biomedical physician may be more likely to attribute disease to biomedical causes although this effect could of course go in either direction, and this effect was maintained when controlling for years of maternal education. Similarly, there is a significant positive effect of having electricity on whether the mother attributed disease to biomedical causes, suggesting that income may play an important role in determining health beliefs. However, when controlling for maternal education, the effect of electricity was not maintained.

Choice of Attendant

Finally, I examined the effect of age, ethnicity, number of children, electricity status, and education on which type of attendant a mother chose for her delivery. The histogram of delivery attendant is shown in Figure 9, where midwife is "0" and biomedical professional is "1." Although attendant was used primarily as a control throughout this study, who attends a woman's delivery may also reflect greater societal trends that help to interpret the results above. It is important to note that this may not always be a personal choice for a particular women, as

social influence or economic factors (shown below) may leave her little option but to choose one or the other.

	Estimate	Std. Error	T value	Pr	
(Intercept)	-3.56624	0.53841	-6.624	3.50e-11	***
Age	0.10483	0.02396	4.375	1.21e-05	***
Eth: Ladina	1.02864	0.17954	5.729	1.01e-08	***
Eth: Both	1.95616	0.66427	2.945	0.00323	**
Eth: No distinction	14.61291	535.41119	0.027	0.97823	
Number children	-0.44047	0.06607	-6.667	2.62e-11	***
Electricity	0.30309	0.18083	1.676	0.09372	.
Education	0.02701	0.02199	1.228	0.21928	

Table 16: Results of regression analysis for type of delivery attendant based on maternal traits. Midwife attendant coded as 0; biomedical attendant, 1.
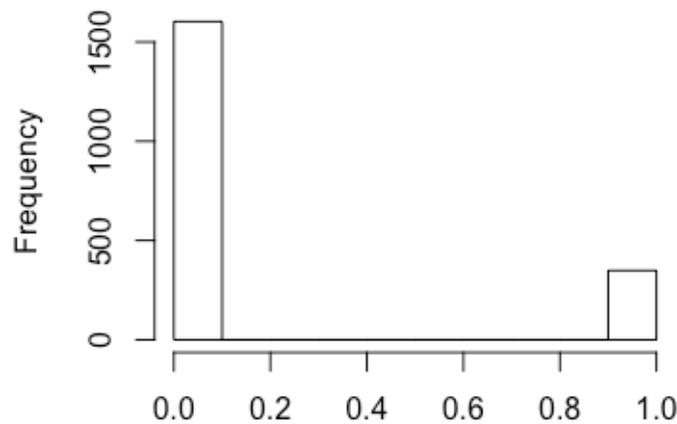

Figure 9: Histogram of Attendant Choice.

Results indicate a positive effect of age on attendant choice, suggesting that older mother are more likely to choose a biomedical professional (Table 16). Similarly, Ladina ethnicity, and mixed indigenous and Ladina ethnicity also have a positive effect on choosing a biomedical professional compared to their pure indigenous counterparts. There is also a positive effect at the $p<0.1$ level of electricity on choosing a biomedical professional, which suggests that lower-

income women are more likely to be attended by a midwife. On the other hand, there is a negative effect of number of children on choice of attendant, suggesting the women with more children are more likely to choose a midwife to attend the delivery.

Discussion

The results from the household portion of this study deepen the story told by the analysis of midwife responses, and raise additional questions. Key results of the initial analysis suggested that having a divine calling into midwifery has a significant negative effect on referral frequency. Similarly, midwives who were divinely called were significantly busier than those recruited by biomedical means. Although the midwives in the household data could not be separated into those who had taken a course and those who had not, the current analysis sought to investigate the effect on maternal practices of having a midwife versus a biomedical attendant. However, other factors affecting maternal practice, such as ethnicity and electricity status, also emerged.

Results of the current analysis suggest that women attended by midwives are more likely to breastfeed, and they are more likely to breastfeed for a longer period of time. Breastfeeding is known to improve the child's health and social measures well into adulthood, as well as to increase the health of the mother by lowering incidence of breast cancer and increasing birth spacing (Victora et al., 2016). The WHO promotes exclusive breastfeeding for the first six months of the child's life. Afterwards, they strongly encourage breastfeeding as a supplement to a solid diet. (Davis, Fischer, Rohloff, & Heimburger, 2014). Efforts such as those by the WHO may have impacted the mothers interviewed in the current study.

Although these results are positive in terms of midwife effect on maternal practices, it is nonetheless surprising that the effect favors midwives as opposed to biomedical professionals. Given the surfeit of scientific support for the positive effects of breastfeeding, one would assume

that biomedical practitioners would be even more likely to recommend the practice to their patients. Therefore, we must recognize that this result may be a function of the type of attendant that a particular mother uses, as opposed to the effect the midwife may have on the mother. Similarly, the type of attendant may simply be an indicator of other factors. For example, increased breastfeeding in women who choose midwives may be due to an income effect, as breastfeeding duration tends to be shorter in nations with higher incomes (Victora et al., 2016).

Beyond breastfeeding, delivery attendant may also have an impact on whether the child received a follow-up visit by a provider. Results suggest that women attended by a biomedical professional are more likely to receive a follow-up for their child. However, type of attendant has no effect on whether mother receives a follow-up. These results were somewhat incongruous with midwife analysis, which indicated that midwife training had no impact on whether a midwife followed-up with patients. Biomedical professionals (such as those teaching midwife training courses), evidently see follow-up as an important aspect of the care cycle, but this emphasis has not been mirrored by traditional practitioners in the region.

Therefore, it is evident that there are benefits to having either type of attendant, depending on the maternal practice that is being considered. This emphasizes that one "way of knowing" does not have complete dominance over the other (Chen & Collier, 2012). On the contrary, both schools of thought—traditional and biomedical—can positively influence maternal practices. Similarly, both forms of practice can learn important lessons from providers of the other school. Policy makers must take this into account when attempting to incorporate midwives in the formal healthcare system, and acknowledge the importance of collaboration during midwife training sessions.

However, these results are complicated when examining the effect of various factors on choice of attendant. My results indicate that choice of attendant is highly affected by age, ethnicity, electricity status, and number of children that the mother has had. Therefore, although type of attendant initially appears to be the most important factor, many others undoubtedly play a role. These results indicate that improvement of maternal practices such as follow-up frequency may need to be partially addressed by an improvement in access, a result that is mirrored in the midwife portion of the study. On the other hand, improving breastfeeding among Ladina women requires an entirely different approach. The decreased frequency and duration may be due to cultural norms that encourage breastfeeding only to a certain age. Similarly, these Ladina women may be more likely to have jobs outside the home than their indigenous counterparts, making breastfeeding less convenient. In this case, reforms may need to target employer policies.

However, attendant is not always the primary determinant of maternal factors, and ethnicity may also play an important role. First, we show that ethnicity likely plays a significant role in a woman's choice of delivery attendant, with Ladina mothers and mothers who identify as "both" more likely to choose a biomedical professional than their indigenous counterparts. Similarly, Ladina mothers are both less likely to breastfeed and breastfeed for a shorter period than indigenous counterparts. As these results controlled for age, education, electricity status, and number of children, they suggest that a woman's cultural tradition also plays a significant role in the choices she makes for her child. The effects of ethnicity are not isolated to breastfeeding, as children of Ladina women are also significantly more likely to receive follow up than children of indigenous women.

Although this portion of the study has primarily examined actual maternal practices, these practices are informed by health beliefs that also warrant study. Analysis of these beliefs

indicates a positive effect of both attendant and electricity on health beliefs. These results suggest that mothers with electricity are more likely to attribute disease to biomedical causes and that socioeconomic status may be the most significant predictor of health beliefs. Surprisingly, neither ethnicity nor age are significant predictors of health beliefs. Analysis also indicated an effect on type of attendant, although only at the $p<0.1$ level. Mothers attended by biomedical physicians were more likely to attribute disease to biomedical causes. However, it is important to note that causality, if present, could go in either direction. On one hand, the attendant may influence beliefs, yet which type of attendant mothers utilized may be due to health beliefs. Gaining leverage over this question would likely require a randomized control trial or other sophisticated methods of analysis (Sibley et al., 2004).

Overall, the results of both the current analysis and the midwife study emphasize the multitude of factors that influence both healthcare provider and maternal choices. In the case of the midwives, divine calling appears to have an extremely significant effect, perhaps more so than whether she has taken a course or was formally educated. In the case of mothers, both attendant and ethnicity played significant roles in breastfeeding choices and follow-up visits for the child. However, choice of attendant was also significantly impacted by age, ethnicity, number of children, and electricity status, further complicating the story.

Conclusion

In general, healthcare authorities in developing countries face serious challenges in their efforts to improve maternal and infant health outcomes, including limited funding, poor healthcare infrastructure, and resistance to changing traditional beliefs. Although the state is generally linked to the biomedical perspective, tradition knowledge often has more legitimacy within rural communities and also includes some practices that are both more effective and pragmatic than those espoused by biomedical practitioners. Governments in developing nations such as Guatemala have utilized several models to improve health outcomes of rural populations. For example, the state can adopt a perspective of cultural relativism that allows each group to exclusively utilize their own traditional practices. However, this perspective sacrifices the possible benefits to human health and well-being that biomedical advances provides.

On the other hand, states can replace traditional providers such as midwives with biomedical providers. This process marginalizes traditional understanding and fails to recognize the considerable worth of indigenous knowledge that has developed over centuries of practice. Similarly, the new providers are unlikely to be utilized by the communities in which they practice. The current study provides evidence of this, suggesting that communities more readily utilize providers called by traditional means rather than those recruited into the role by the Ministry of Health. Therefore, biomedical ones would fail to impact as large a portion of the population as the traditional providers they replaced. Furthermore, it may diminish use of the positive practices used only by traditional providers and not yet espoused by the formal healthcare system.

The final mode of improving health outcomes, and the one advocated by most scholars, is the incorporation of biomedical principles within the existing cultural framework of medical

practices (Byrne & Morgan, 2011; Dana A. Glei et al., 2003; Greenberg, 1982). This method identifies and then utilizes social networks to disperse important health information. In this case of this study, midwives are trained by biomedical health workers and urged to spread positive biomedical practices among their patients, such as immunization and receiving regular check-ups. Guatemala provides an excellent case study of this process because of available data, a historically weak state, and the widespread adherence to traditional practices.

The current study supports this model of incorporating traditional practitioners. Results suggest that which provider attends birth may play a role in maternal practices. For example, mothers attended by midwives are more likely to breastfeed, and more likely to breastfeed for a longer period of time. Similarly, mothers who were attended by biomedical practitioners are more likely to have children that receive follow-up visits. These results indicate that a second method of improving health outcomes, enhancing existing networks through medicalization, may be a more effective option. This model primarily seeks to enhance the perspectives of traditional providers by education in certain biomedical principles. The midwives then disseminate this knowledge to their patients.

However, public health is undoubtedly affected by factors beyond delivery attendant and formal policies such as SIAS (Bailey et al., 2002; D.A. Glei & Goldman, 2000). The current study illustrates that several practices —such as health beliefs, immunization, and infant receiving follow-up visit— were not only affected by delivery attendant, but also by ethnicity or electricity status. Even the type of delivery attendant had several significant predictors, including age, ethnicity, and electricity status. These results indicate that simply training midwives to disseminate certain information will not necessarily improve maternal practices to an appropriate level. Rather, the issue of poor health outcomes is also impacted by deeper structural

implications of ethnicity and underdevelopment. It is important to acknowledge that health inequalities will not be significantly and permanently improved without addressing these issues, and that the Ministry of Health cannot accomplish this feat alone.

The current study also illustrates the staying power of traditional practices, particularly those informed by either religious or ethnic tradition. For example, my results suggest that the divine calling of certain midwives has a greater impact on referral frequency than other forms of education, such as a midwifery course or formal education. Other ethnographic work supports this finding, demonstrating that many midwives feel their authority is divinely granted, rather than educationally or experientially earned (Cosminksy, 2001; Paul & Paul, 1975; Rogoff, 2011). Therefore, efforts to train midwives in new, biomedical practices must be done respectfully and without marginalizing the valuable understanding they have gained from years of practice. Similarly, health educators must avoid challenging midwives' authority to avoid ostracizing these experienced providers.

My contribution to the current state of the field is an overall evaluation of the effects of the biomedical-traditional hybrid model throughout rural Guatemala. Rather than treating this as a local phenomenon, my study examines the effects of medicalization on a large and diverse population of mothers. Key results indicate that divine calling has a significant effect on midwife practice, and in turn, that delivery attendant, ethnicity, and electricity status significantly affect maternal practices. Similarly, results suggest that different practices have different predictors, and that structural inequalities also contribute to poor health practices by mothers. Although these results are suggestive, they are also preliminary, and more recent studies with larger midwife sample size are required to obtain a fuller picture of both midwife and maternal practices in rural Guatemala.

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